

# Electrical Shock

CoreNotes by Core Concepts Anesthesia Review, LLC

## What You Must Know

1. Electrical shocks (ES) occur when a person completes a circuit.
2. Injury occurs from the release of thermal energy from the ES and disruption of nervous, muscular and cardiac functions.
3. The extent of injury following ES is a function of the current and time of the ES.
4. ES can be broadly divided into macroshock and microshock.
5. Microshock is the result of direct delivery of current to the myocardium in “susceptible” patients, e.g. patients with pacemakers, AICDs, central lines, etc.

**120 Volt, 60 Hz for 1-second Contact**

Current	Effect
<i>Macroshock</i>	
1 mA	Threshold of perception
5 mA	Maximum “harmless” current
10 – 20 mA	“Let-go” current before sustained muscle contraction
50 mA	Pain and possible mechanical injury
100 – 300 mA	Ventricular fibrillation
<i>Microshock</i>	
20 – 100 $\mu$ A	Ventricular Fibrillation
10 $\mu$ A	Recommended maximum leakage current

Electrical shock occurs when a person becomes part of, or completes an electrical circuit. Injury is the result of both the release of thermal energy and the disruption of normal cellular electrical activity in the nervous system, muscular system and cardiac system. The degree of injury is directly related to the amount of current conducted and the time the current is conducted. Often ES injury is not readily visible and the result of significant thermal injury to the internal organs.

Microshock is the result of very small currents applied directly to the myocardium. Under these circumstances, currents of only 20 – 100  $\mu$ A are sufficient to induce ventricular fibrillation. Since this amount of current is well below the threshold of perception and electrical circuit protection used in the OR, we must be aware of the risk of microshock in “susceptible” patients. Susceptible patients include patients who have a direct conduit into the heart, capable of conducting electricity. Such conduits include pacemakers, AICDs, pulmonary artery catheters, central venous catheters, etc.

### Additional Reading:

Barash, PG, Cullen, BF, Stoelting, RK, Cahalan, MK, Stock, MC, Ortega, R, Sharar, SR, and Holt, NF. Clinical Anesthesia. Philadelphia: Lippincott Williams & Wilkins, 2017:112